

Freshwater Invertebrates of Jindo Island in Korea

Dong-Ha Ahn^{1,2}, Chi-Woo Lee¹, Hee-Min Yang¹, Ji-Hun Song¹, Jae-In Kwon¹,
Su-Jung Ji¹, Mi-Hyun Park¹, Gi-Sik Min^{1,*}

¹Department of Biological Sciences, Inha University, Incheon 22212, Korea

²SOKN Institute of Ecology and Conservation, Seoul 03043, Korea

ABSTRACT

We surveyed the freshwater invertebrates of Jindo Island twice on July and September 2016, as part of a joint faunal survey conducted to commemorate the 30th anniversary of the Korean Society of Systematic Zoology. Aquatic insects were not included in this study. We found 38 freshwater species from seven phyla: Porifera, Platyhelminthes, Nematomorpha, Mollusca, Annelida, Arthropoda, and Bryozoa. Twenty-one of the 38 species (55.3%) represented the first record of their respective species on Jindo Island. Among these species, a freshwater shrimp-parasitic isopod, *Tachaea* n. sp., was identified as a new species.

Keywords: Jindo Island, freshwater, invertebrate, fauna, Korea

INTRODUCTION

Freshwater invertebrates, including aquatic insects, have been used as biological indicators of water pollution and as factors in ecotoxicological assessments because most of these specialized inhabitants of diverse water environments are sensitive to environmental changes (Kim et al., 2013).

Jindo Island (34°08'–34°35'N, 125°37'–126°28'E) is the third largest island of Korea and it is located in the southwestern part of the Korean Peninsula. Several faunal (Ministry of Environment, 1998; National Institute of Environmental Research, 2004, 2012) and taxonomic studies (Chung and Kim, 1995; Yoon et al., 1995; Yoo, 1996; Rho et al., 2005) of freshwater invertebrates (excluding aquatic insects) have been conducted previously from the restricted areas of Jindo Island.

To verify the diversity of freshwater invertebrates on Jindo Island, we conducted a faunal survey from 14 sites on the island. Regarding the ecological aspects, the survey sites represented diverse freshwater habitats in Jindo Island, including mountain streams, rice paddies, agricultural waterways, swamps, reservoirs, and even subterranean waters. Aquatic insects were not included in this study. This survey was conducted as part of the joint faunal survey of Jindo Island in 2016 to commemorate the 30th anniversary of the Korean Society of Systematic Zoology (KSSZ).

MATERIALS AND METHODS

Faunal surveys were conducted from 14 sites in Jindo Island, Korea, on 6–9 Jul and 21–23 Sep, 2016 (Table 1, Fig. 1). Specimens were mainly collected from several freshwater habitats, including streams, pools, and reservoirs, using skimming nets (mesh size, 5 mm) and scoop nets (mesh sizes, 1 mm or 6 mm). We sampled planktonic taxa using conical plankton nets (mouth diameter, 20 cm; mesh size, 20 µm). For subterranean fauna, we performed core sampling (core diameter, 33 mm; hole diameter, 5 mm or 8 mm) using a hand pump. The pumped water samples were concentrated using conical plankton nets (mouth diameter, 20 cm; mesh size, 50 µm). Specimens were fixed using 95% ethyl alcohol and were identified based on morphological characteristics. A stereoscopic microscope (SZX-7; Olympus, Tokyo, Japan) and a light microscope (DM 2500; Leica, Wetzlar, Germany) were used to conduct more detailed observations. All examined specimens were deposited at the Department of Biological Sciences, Inha University, Korea.

All collected specimens were identified based on descriptions in the literatures: general freshwater invertebrates (Thorp and Rogers, 2011; Kim et al., 2013; Kwon et al., 2013), molluscans (Kwon, 1990; Min et al., 2004), annelids (Yamaguchi, 1934; Park and Kim, 1989; Song, 1995), shrimps (Kim, 1977), and copepods (Chang, 2009, 2012,

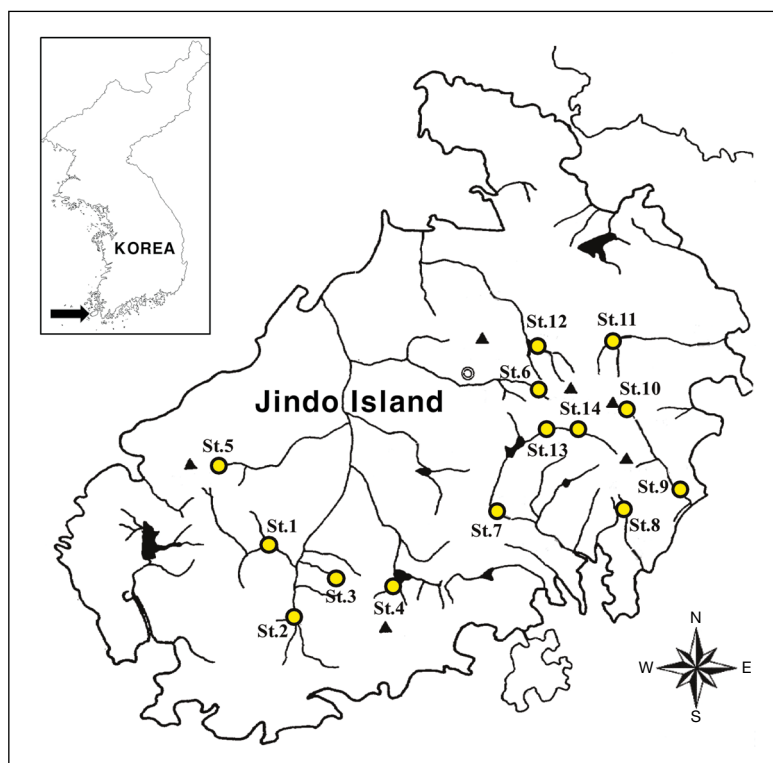
© This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

***To whom correspondence should be addressed**

Tel: 82-32-860-7692, Fax: 82-32-874-6737
E-mail: mingisik@inha.ac.kr

Table 1. Geological information for collection sites on Jindo Island

Site	Collection site	GPS coordinates
St. 1	Samdang-ri, Jisan-myeon	34°25'13"N, 126°10'43"E
St. 2	Seokgyo-ri, Imhoe-myeon	34°24'15"N, 126°11'32"E
St. 3	Saryeong-ri, Imhoe-myeon	34°24'41"N, 126°12'24"E
St. 4	Yongho-ri, Imhoe-myeon	34°24'33"N, 126°14'05"E
St. 5	Goya-ri, Jisan-myeon	34°26'57"N, 126°10'03"E
St. 6	Dongoe-ri, Jindo-eup	34°28'53"N, 126°17'00"E
St. 7	Changpo-ri, Uisin-myeon	34°26'12"N, 126°16'20"E
St. 8	Chosa-ri, Uisin-myeon	34°26'14"N, 126°19'52"E
St. 9	Geumgye-ri, Gogun-myeon	34°26'34"N, 126°21'14"E
St. 10	Hyangdong-ri, Gogun-myeon	34°27'58"N, 126°20'08"E
St. 11	Osan-ri, Gogun-myeon	34°29'58"N, 126°19'58"E
St. 12	Wolga-ri, Gunnae-myeon	34°29'36"N, 126°17'35"E
St. 13	Sacheon-ri, Uisin-myeon	34°27'56"N, 126°18'05"E
St. 14	Ssanggyesa Valley, Uisin-myeon	34°28'11"N, 126°18'30"E


Fig. 1. Map showing the collection sites (St. 1–14) on Jindo Island. St. 1, Samdang-ri; St. 2, Seokgyo-ri; St. 3, Saryeong-ri; St. 4, Yongho-ri; St. 5, Goya-ri; St. 6, Dongoe-ri; St. 7, Changpo-ri; St. 8, Chosa-ri; St. 9, Geumgye-ri; St. 10, Hyangdong-ri; St. 11, Osan-ri; St. 12, Wolga-ri; St. 13, Sacheon-ri; St. 14, Ssanggyesa Valley.

2013, 2014). The scientific nomenclature and classification system used in this study was based on the “List of Animals in Korea (excluding insects)” (KSSZ, 1997) and “National List of Species of Korea” (Ministry of Environment, 2012, 2013, 2014, 2015a, 2015b). The species identified in this study were listed.

RESULTS AND DISCUSSION

We identified a total of 38 species from 29 families, 17 orders, 10 classes, and seven phyla. Of the seven phyla, Arthropoda had the greatest species richness with 15 species (39.5%), followed by Mollusca (12 species, 31.6%), Annelida (seven species, 18.4%), Porifera (one species, 2.6%),

Platyhelminthes (one species, 2.6%), Nematomorpha (one species, 2.6%), and Bryozoa (one species, 2.6%) (Fig. 2). The specimens collected from each of the 14 sites on Jindo Island are listed in Table 2. Of these, *Semisulcospira libertina* (Gould, 1859), *S. tegulata* (v. Martens, 1894), *Radix auricularia* (Linnaeus, 1758), and *Dugesia japonica* Ichikawa and Kawakatsu, 1964 were the most predominant throughout Jindo Island. Endangered and legally protected species were not found in this survey. For subterranean fauna, three species [two copepods (*Acanthocyclops tokchokensis* Kim and Chang, 1991 and *Tropocyclops setulifer* Lee and Chang, 2007) and one amphipod (*Pseudocrangonyx coreanus* Ueno, 1966)] were collected and identified from Site 2 (Table 2). The photographs of representative species collected during this survey are shown in Fig. 3.

The following systematic list contains all of the species identified in this study. The single asterisk (*) indicates that the species was newly recorded on Jindo Island in this study, and the double asterisk (**) indicates that the species was newly recorded in the Korean fauna.

Phylum Porifera Grant, 1836
Class Demospongiae Sollas, 1885
Order Haplosclerida Topsent, 1928
Family Spongillidae Gray, 1867

***1. Spongillidae sp.**

Remarks. Based on the global distribution of the Spongillina (suborder, freshwater sponges) families, only Spongillidae is distributed on the Korean Peninsula (Hooper and Van Soest, 2002). Freshwater sponges in the family Spongillidae are difficult to identify, because the shape of spicules is very similar in all members of this family.

Phylum Platyhelminthes Claus, 1887
Class Turbellaria Ehrenberg, 1831
Order Tricladida Lang, 1884
Family Planariidae Stimpson, 1857

2. *Dugesia japonica* Ichikawa and Kawakatsu, 1964
MOE, 1998; NIER, 2012 (Jindo Island).

Phylum Nematomorpha Vejdovsky, 1886
Class Gordioida Rauther, 1930
Order Chordidea Rauther, 1930
Family Chordodidae May, 1919

***3. *Chordodes* sp.**

Phylum Bryozoa Ehrenberg, 1831

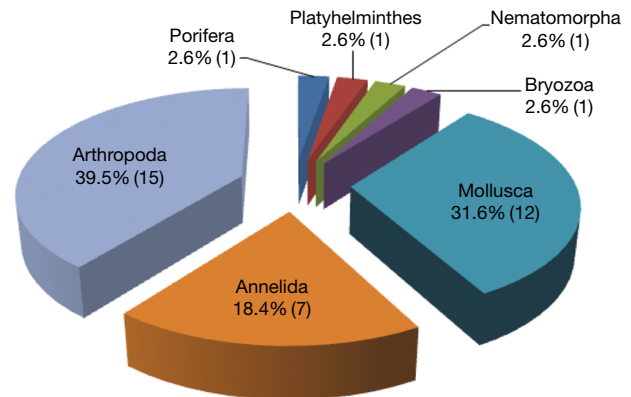


Fig. 2. Species composition of major groups of freshwater invertebrates (excluding insects) from Jindo Island (number of species in parentheses).

Class Phylactolaemata Allman, 1856
Family Lophopodidae Rogick, 1935

***4. *Asajirella gelatinosa* (Oka, 1891)**

Phylum Mollusca Linnaeus, 1758
Class Gastropoda Cuvier, 1795
Order Mesogastropoda Thiele, 1925
Family Viviparidae Gray, 1847

5. *Cipanhopaludina chinensis malleata* (Reeve, 1863)
MOE, 1998 (Jindo Island).

Family Ampullariidae Gray, 1824

***6. *Pomacea canaliculata* (Lamark, 1819)**

Family Pleuroceridae Fischer, 1885

7. *Semisulcospira libertina* (Gould, 1859)
MOE, 1998; NIER, 2004, 2012 (Jindo Island).

8. *Semisulcospira tegulata* (v. Martens, 1894)
MOE, 1998; NIER, 2004 (Jindo Island).

Order Basommatophora Keferstein, 1865
Family Lymnaeidae Rafinesque, 1815

9. *Radix auricularia* (Linnaeus, 1758)
MOE, 1998; NIER, 2004, 2012 (Jindo Island).

Family Physidae Fitzinger, 1833

10. *Physa acuta* Draparnaud, 1805

Table 2. Occurrence of freshwater invertebrates (excluding insects) from 14 sites on Jindo Island

Taxon	Sites													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Spongillidae sp.		•												
<i>Dugesia japonica</i>	•		•	•	•	•	•	•			•	•	•	•
<i>Chordodes</i> sp.		•	•	•							•			
<i>Asajirella gelatinosa</i>			•											
<i>Cipanhopaludina chinensis malleata</i>	•	•		•							•			
<i>Pomacea canaliculata</i>	•	•					•				•			
<i>Semisulcospira libertina</i>	•	•	•	•	•	•		•	•	•	•	•	•	
<i>Semisulcospira tegulata</i>		•	•	•	•	•	•	•			•	•	•	
<i>Radix auricularia</i>	•	•	•	•		•	•		•		•	•		
<i>Physa acuta</i>							•	•	•		•	•	•	
<i>Gyraulus convexiusculus</i>								•						
<i>Hippeutis cantori</i>	•					•	•		•					
<i>Anodonta arcaeformis</i>	•	•		•							•			
<i>Anodonta woodiana</i>											•			
<i>Corbicula leana</i>	•	•												
<i>Sphaerium lacustre japonicum</i>	•					•		•						
<i>Cirrodrilus kawamurai</i>			•	•	•			•		•		•		•
<i>Cirrodrilus chosen</i>				•	•			•		•				•
<i>Hidejiodrilus koreanus</i>										•				
<i>Limnodrilus gotoi</i>							•		•					
<i>Alboglossiphonia lata</i>	•	•				•	•	•			•			
<i>Hirudo nipponia</i>		•	•			•			•			•		
<i>Erpobdella lineata</i>	•				•	•	•	•			•		•	
<i>Acanthodiaptomus</i> sp.											•			
<i>Neodiaptomus schmackeri</i>												•		
<i>Acanthocyclops tokchokensis</i> ^a		•												
<i>Tropocyclops setulifer</i> ^a		•												
<i>Thermocyclops taihokuensis</i>				•							•	•		
<i>Eucyclops roseus</i>				•										
<i>Cypretta seurati</i>								•						
<i>Asellus hilgendorffii</i>							•							
<i>Tachaea</i> n. sp.												•		
<i>Gammarus sobaegensis</i>					•					•		•		•
<i>Pseudocrangonyx coreanus</i> ^a		•												
<i>Neocaridina denticulata</i>								•				•		
<i>Palaemon paucidens</i>			•	•			•	•			•	•		
<i>Macrobrachium nipponense</i>								•	•	•		•		
<i>Cambaroides similis</i>			•	•	•			•		•		•		•
Total (38 species)	11	14	10	13	8	9	11	15	7	7	15	15	5	5

^a Taxon collected from subterranean fauna sampling.

MOE, 1998 (Jindo Island).

Family Planorbidae Rafinesque, 1815

*11. *Gyraulus convexiusculus* (Hutton, 1849)

*12. *Hippeutis cantori* (Benson, 1850)

Class Bivalvia Linnaeus, 1758

Order Unionoida Stoliczka, 1871

Family Unionidae Fleming, 1828

13. *Anodonta arcaeformis* Heude, 1877

MOE, 1998 (Jindo Island).

*14. *Anodonta woodiana* (Lea, 1834)

Order Veneroida H. & A. Adams, 1856

Family Corbiculidae Gray, 1847

*15. *Corbicula leana* Prime, 1864

Family Pisidiidae Gray, 1857

*16. *Sphaerium lacustre japonicum* (Westerlund, 1883)

Phylum Annelida Lamarck, 1809

Class Clitellata

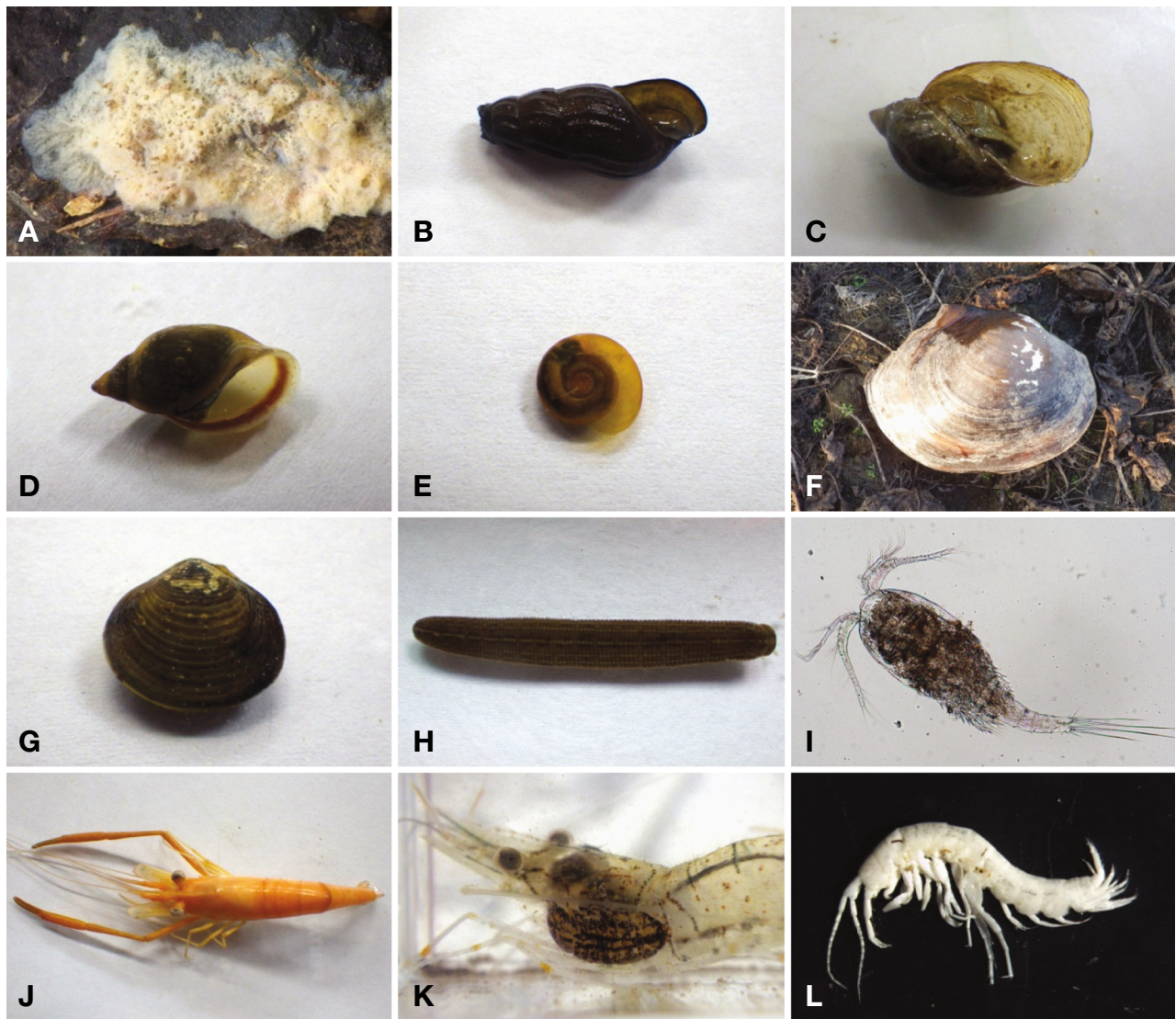


Fig. 3. Examples of freshwater invertebrates from Jindo Island. A, Spongillidae sp.; B, *Semisulcospira tegulata*; C, *Radix auricularia*; D, *Physa acuta*; E, *Hippeutis cantor*; F, *Anodonta woodiana*; G, *Corbicula leana*; H, *Hirudo nipponia*; I, *Acanthocyclops tokchokensis*; J, *Macrobrachium nipponense*; K, *Palaemon paucidens* with a parasitic isopod (*Tachaea* n. sp.); L, *Pseudocrangonyx coreanus*.

Order Branchiobdellida Holt, 1965
Family Branchiobdellidae Odier, 1823

***17. *Cirrodriulus kawamurai* (Yamaguchi, 1934)**

***18. *Cirrodriulus chosen* (Yamaguchi, 1934)**

Family Bdellodrilidae Holt, 1986

***19. *Hidejiodrilus koreanus* (Pierantoni, 1912)**

Subclass Oligochaeta

Order Tubificida
Family Tubificidae Vejdovsky, 1884

***20. *Limnodrilus gotoi* Hatai, 1899**

Subclass Hirudinea Linnaeus, 1758
Order Rhynchobdellida Blanchard, 1894
Family Glossiphoniidae Vaillant, 1890

***21. *Alboglossiphonia lata* (Oka, 1910)**

Order Arhycobdellida Blanchard, 1894

Family Hirudinidae Whitman, 1886

22. *Hirudo nipponia* Whitman, 1886
MOE, 1998; NIER, 2004 (Jindo Island).

Family Erpobdellidae Blanchard, 1894

23. *Erpobdella lineata* (Muller, 1774)
MOE, 1998; NIER, 2012 (Jindo Island).

Phylum Arthropoda Latreille, 1829

Class Maxillopoda Dahl, 1956

Order Calanoida Sars, 1903

Family Diaptomidae Baird, 1850

***24. *Acanthodiaptomus* sp.**

Remarks. To date, only one species, *Acanthodiaptomus pacificus* (Burckhardt, 1913), has been identified on the Korean Peninsula (Chang, 2009). A comprehensive taxonomic study of *Acanthodiaptomus* specimens collected from Jindo Island, based on morphological and molecular characters, is in progress.

***25. *Neodiaptomus schmackeri* (Poppe and Richard, 1892)**

Order Cyclopoida Burmeister, 1834

Family Cyclopidae Rafinesque, 1815

***26. *Acanthocyclops tokchokensis* Kim and Chang, 1991**

Remarks. *Acanthocyclops tokchokensis* was first reported from wells in Deokjeokdo (=Tokchokdo) Island in Korea (Kim and Chang, 1991). The specimens were collected using core sampling from the underground water flow (depth, 1 m) at Seokgyo-ri (Site 2) of Jindo Island.

27. *Tropocyclops setulifer* Lee and Chang, 2007
Lee and Chang, 2007 (Ssanggyesa Temple, Jindo Island); Chang, 2009 (Jindo Island).

28. *Thermocyclops taihokuensis*
Yoon et al., 1995 (Jindo Island).

29. *Eucyclops roseus* Ishida, 1997
Chang, 2009 (Jindo Island).

Class Ostracoda Latreille, 1802

Order Podocopida Sars, 1866

Family Cyprididae Baird, 1845

***30. *Cypretta seurati* Gauthier, 1929**

Class Malacostraca Latreille, 1802

Order Isopoda Latreille, 1817

Family Asellidae Rafinesque, 1815

31. *Asellus hilgendorffii* Bovallius, 1886
Kwon, 1988: 221–232 (Kwansado Island, Jindo-gun); MOE, 1998; NIER, 2012 (Jindo Island).

Family Corallanidae Hansen, 1890

****32. *Tachaea* n. sp.**

Remarks. *Tachaea* n. sp. was identified as a new species. This taxon is a freshwater shrimp-parasitic isopod that is new to science. A comprehensive taxonomic study of the Korean *Tachaea* species, based on morphological and molecular characters, is in progress.

Order Amphipoda Latreille, 1816

Family Gammaridae Leach, 1814

33. *Gammarus sobaegensis* Ueno, 1966
Lee and Kim, 1980: 46–47 (Jindo Island); NIER, 2012 (Jindo Island).

Family Pseudocrangonyctidae Holsinger, 1989

***34. *Pseudocrangonyx coreanus* Ueno, 1966**

Remarks. The specimens collected from Jindo Island were congruent with the illustrations and the original descriptions (Ueno, 1966) of specimens collected from caves and wells on the mainland regions of the Korean Peninsula. The species was identified based on the following characteristics: (1) uropod 3, distal joint from 1/3 to 1/2 the length of proximal joint; (2) antenna 2, flagellum with 4–5 joints; (3) depth of emargination of telson 1/5 or less of its own length; and (4) maxilla 1 with 2–3 setae on inner plate.

Order Decapoda Latreille, 1802

Family Atyidae De Haan, 1849

35. *Neocaridina denticulata* (De Haan, 1884)
Rho et al., 2005: 16 (Dongoeje, Jindo Island).

Family Palaemonidae Rafinesque, 1815

36. *Palaemon paucidens* De Haan, 1884

MOE, 1998 (Jindo Island); Rho et al., 2005: 16 (Dongoeje, Jindo Island); NIER, 2012 (Jindo Island).

***37. *Macrobrachium nipponense* (De Haan, 1849)**

Family Cambaridae Hobbs, 1942

38. *Cambaroides similis* (Koelbel, 1892)

Kim, 1976: 148 (Haedong, Jindo Island); MOE, 1998; NIER, 2004, 2012 (Jindo Island).

Of the 38 species, 21 (55.3%) were newly recorded on Jindo Island in the present survey. Regarding Korean fauna, one freshwater shrimp-parasitic isopod, *Tachaea* n. sp., represents an unrecorded genus and family. The genus *Tachaea* Schioedte & Meinert, 1879 belongs to the family Corallanidae Hansen, 1890 and is currently composed of seven species found worldwide (Bruce and Schotte, 2015). This taxon is mainly found on the carapace of palaemonid shrimps (especially the genera *Palaemon* and *Macrobrachium*) in standing freshwater habitats (Fig. 3K).

From a biogeographic point of view, the occurrence of the subterranean amphipod *Pseudocrangonyx coreanus* on Jindo Island is an interesting and noteworthy finding. Only two species of this subterranean species of pseudocrangonyctid amphipod, *P. asiaticus* Ueno, 1934 and *P. coreanus* Ueno, 1966, have been observed in South Korea to date (Ueno, 1966; Kim et al., 2004). The distribution of *P. coreanus* only ranges across some mainland regions (Gangwon-do, Gyeongsangbuk-do, and Chungcheongnam-do Provinces) on the Korean Peninsula (Ueno, 1966). In the present study, the collection of *P. coreanus* as a subterranean amphipod from Jindo Island (Fig. 3L) was the first record of species occurrence extending to the islands of Korea. This potentially suggests that subterranean amphipods could also live on other Korean islands (with the exception Jindo).

Similarly, three crayfish-worms (Annelida, Branchiobdellida), *Cirrodriulus kawamurai* (Yamaguchi, 1934), *C. chosen* (Yamaguchi, 1934), and *Hidejiodriulus koreanus* (Pierantoni, 1912), were reported on Jindo Island for the first time. The existence of the Korean crayfish (*Cambaroides similis* (Koelbel, 1892)) on Jindo Island has been known for approximately 40 years (Kim, 1976, 1977). However, the crayfish-worms that commensally live attached to the carapace of the crayfish have never been recorded before.

The present faunal survey was conducted on a range of invertebrate taxa that was more diverse than that examined in previous studies of Jindo Island taxa. This study also included meaningful and valuable reports of the discovery of new species or new distributions of existing Korean fauna.

Nevertheless, the survey is not yet complete, and further comprehensive studies that investigate the diversity of freshwater invertebrates on Jindo Island are needed to generate broader taxonomic and biogeographic information.

ACKNOWLEDGMENTS

This study was supported by a grant from the National Institute of Ecology (NIE), funded by the Ministry of Environment (MOE) of the Republic of Korea.

REFERENCES

- Bruce NL, Schotte M, 2015. *Tachaea* Schioedte & Meinert, 1879. In: (2008 onwards) World Marine, Freshwater and Terrestrial Isopod Crustaceans database (Eds., Boyko CB, Bruce NL, Merrin KL, Ota Y, Poore GCB, Taiti S, Schotte M, Wilson GDF) [Internet]. World Register of Marine Species, Accessed 2 Nov 2016, <<http://marinespecies.org/aphia.php?p=taxdetails&id=249378>>.
- Chang CY, 2009. Illustrated encyclopedia of fauna & flora of Korea, Vol. 42. Inland-water copepoda. Ministry of Education, Science & Engineering, Seoul, pp. 1-687.
- Chang CY, 2012. Invertebrate fauna of Korea, Vol. 21, No. 19. Continental cyclopoids-I. National Institute of Biological Resources (NIBR), Incheon and Ministry of Environment, Seoul, pp. 1-92.
- Chang CY, 2013. Invertebrate fauna of Korea, Vol. 21, No. 26. Continental cyclopoids-II. National Institute of Biological Resources (NIBR), Incheon and Ministry of Environment, Seoul, pp. 1-110.
- Chang CY, 2014. Invertebrate fauna of Korea, Vol. 21, No. 35. Continental calanoids. National Institute of Biological Resources (NIBR), Incheon and Ministry of Environment, Seoul, pp. 1-68.
- Chung KS, Kim IH, 1995. Water mites from Chindo Island. Korean Journal of Systematic Zoology, 11:27-37.
- Hooper JNA, van Soest RWM, 2002. Systema Porifera. A guide to the classification of sponges. Kluwer Academic/Plenum Publishers, New York, pp. 1-1764.
- Kim BY, Choi YG, Soh HY, Lee H, Kim WR, Lee W, 2004. A list of cave fauna and research prospect in Korea. Korean Journal of Environmental Biology, 22:12-27.
- Kim HS, 1976. A checklist of Macura (Crustacea, Decapoda) of Korea. Proceedings of the College of Natural Sciences, Seoul National University, 1:131-152.
- Kim HS, 1977. Illustrated encyclopedia of fauna & flora of Korea, Vol. 19. Macura. Ministry of Education, Seoul, pp. 1-414.
- Kim HS, Chang CY, 1991. *Acanthocyclops tokchokensis*, a new cyclopoid copepod species from wells in Tokchok Island of Korea (Copepoda, Cyclopoida, Cyclopidae). Korean Jour-

- nal of Zoology, 34:300-306.
- Kim MC, Chun SP, Lee JK, 2013. Invertebrates in Korean freshwater ecosystems. Geobook, Seoul, pp. 1-483.
- Korean Society of Systematic Zoology (KSSZ), 1997. List of animals in Korea (excluding insects). Academy Press, Seoul, pp. 1-489.
- Kwon DH, 1988. Freshwater *Asellus* (Isopoda, Asellota) from Korea. Inje Journal, 4:221-231.
- Kwon OG, 1990. Illustrated encyclopedia of fauna & flora of Korea, Vol. 32. Mollusca I. Ministry of Education, Seoul, pp. 1-446.
- Kwon SJ, Jeon YC, Park JH, 2013. Benthic macroinvertebrates. Nature & Ecology, Seoul, pp. 1-791.
- Lee JM, Chang CY, 2007. Two new species of *Tropocyclops prasinus* group (Copepoda: Cyclopidae) from South Korea. Integrative Biosciences, 11:255-263. <https://doi.org/10.1080/017386357.2007.9647342>
- Lee KS, Kim HS, 1980. On the geographical distribution and variation of freshwater *Gammarus* in Korea, including descriptions of four new species. Crustaceana, Supplement, 6:44-67.
- Min DK, Lee JS, Ko DB, Je JG, 2004. Mollusks in Korea. Min Molluscan Research Institute, Seoul, pp. 1-566.
- Ministry of Environment (MOE), 1998. The 2nd National Ecosystem Survey: benthic macroinvertebrates of Mt. Cheomchalsan and its adjacent area in Jindo Island. Ministry of Environment, Seoul, pp. 93-110.
- Ministry of Environment (MOE), 2012. National list of species of Korea: invertebrates-I. National Institute of Biological Resources (NIBR), Incheon, pp. 1-213.
- Ministry of Environment (MOE), 2013. National list of species of Korea: invertebrates-IV. National Institute of Biological Resources (NIBR), Incheon, pp. 1-218.
- Ministry of Environment (MOE), 2014. National list of species of Korea: invertebrates-V. National Institute of Biological Resources (NIBR), Incheon, pp. 1-233.
- Ministry of Environment (MOE), 2015a. National list of species of Korea: invertebrates-VI. National Institute of Biological Resources (NIBR), Incheon, pp. 1-206.
- Ministry of Environment (MOE), 2015b. National list of species of Korea: invertebrates-VII. National Institute of Biological Resources (NIBR), Incheon, pp. 1-546.
- National Institute of Environmental Research (NIER), 2004. The 2nd National Ecosystem Survey: benthic macroinvertebrates of Mt. Cheomchalsan and its adjacent area in Jindo Island. Ministry of Environment, Seoul, pp. 99-117.
- National Institute of Environmental Research (NIER), 2012. The 3rd National Ecosystem Survey: benthic macroinvertebrates in Jindo Island. Ministry of Environment, Seoul, pp. 1-5.
- Park KH, Kim CH, 1989. Taxonomic studies on freshwater leeches (= Hirudinea) of Korea. Chungnam Journal of Science, 16:149-158.
- Rho HS, Jung J, Song SJ, Kim W, 2005. Crustacean decapods of Jindo Island, Korea. Korean Journal of Systematic Zoology, Special Issue, 5:13-28.
- Song KR, 1995. Systematics of the Hirudinea (Annelida) in Korea. Ms thesis, Korea University, Seoul, Korea, pp. 1-57.
- Thorp JH, Rogers DC, 2011. Field guide to freshwater invertebrates of North America. Academic Press, Burlington, MA, pp. 1-274.
- Ueno M, 1966. Results of the speleological survey in South Korea 1966, II. Gammarid Amphipoda found in subterranean waters of South Korea. Bulletin of the National Science Museum [Tokyo], 9:501-535.
- Yamaguchi H, 1934. Studies on Japanese Branchiobdellidae with some revisions on the classification. Journal of the Faculty of Science, Hokkaido Imperial University, Series 6 Zoology, 3:177-219.
- Yoo HB, 1996. Freshwater rotifers fauna inhabiting lake Sopo in Jindo, Korea. Korean Journal of Environmental Biology, 14:29-39.
- Yoon SM, Chang CY, Kim W, 1995. An ecological study on the occurrence of freshwater cladocerans and copepods from Chindo, Korea. Korean Journal of Systematic Zoology, 11: 39-64.

Received November 17, 2016

Revised December 6, 2016

Accepted December 7, 2016